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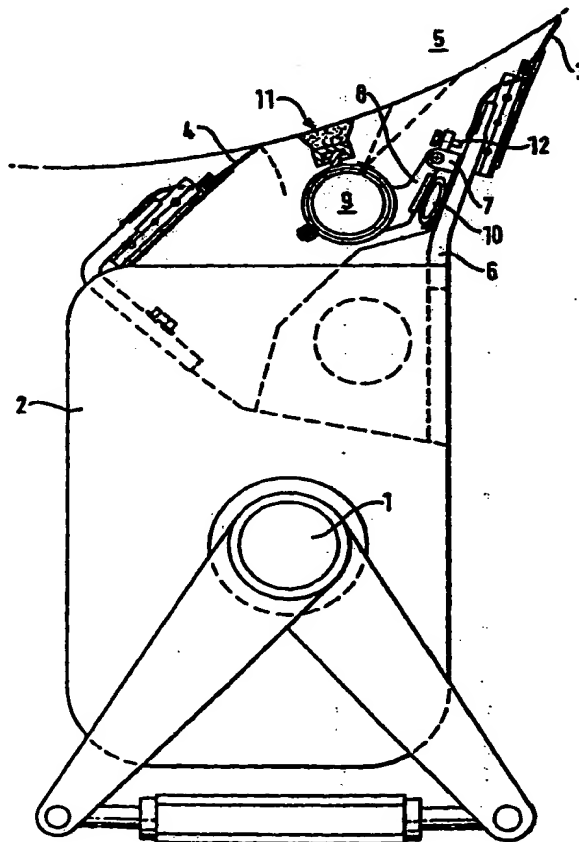
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(54) Title: **IMPROVED DOCTOR BLADE ASSEMBLY**

(57) Abstract

A doctor assembly for a rotating roll (5) comprises a first doctor blade (3) arranged adjacent the roll surface at a first circumferential position and a second doctor blade (4) arranged adjacent the roll surface at a second circumferential position after the first circumferential position in the direction of rotation of the roll (5). Wash spray means (9) directs a wash liquid onto that part of the roll surface between the first and second doctor blades. A wiping element (11) is provided contacting the roll surface between the doctor blades (3, 4).



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IMPROVED DOCTOR BLADE ASSEMBLY

The present invention relates to doctor assemblies, and is particularly concerned with doctor assemblies in which a pair of doctor blades bear on a roll, and have a wash spray means arranged to play on the roll between the blades, or on the rear face of the leading blade.

Paper making machines employ doctors on many of the rolls of the machine and a typical machine can include up to about forty doctors. The paper machine cannot operate effectively, or for very long, without doctors to clean the rolls and to prevent a paper web from wrapping itself round a roll in the event of a web breakage.

The purpose of the vast majority of paper machine doctors is one or more of the following:

Firstly, in the event of the paper web breaking during production, the doctor must prevent the paper from wrapping around the roll. It does this by continuously peeling the web off the roll (when required to do so) and depositing it in a basement or re-pulping vat under the machine, from where it may be recycled.

Secondly, the doctor must keep the roll clean from contaminants which could cause marking of the paper web.

Thirdly, the doctor must remove the paper web from the roll during the start-up procedure of the machine.

A conventional doctor consists of a very accurately made beam which spans the machine in close proximity to the roll which is to be doctored. This beam carries a special holder which, in turn, applies a sharp blade to the roll face so that the blade "shaves" the roll rather like an old-fashioned cut throat razor. The applied load and angle of approach of the blade to the roll are critical to its performance. The blade, which is

sacrificial and readily renewed, is made from a material which is compatible with the roll material, such that the wear to the roll is minimised. Currently, about thirty different blade materials are available.

The most critical doctors on the machine are those known as double or twin doctors. They are used on the most difficult doctoring applications.

Double and twin doctors employ two blades instead of one, and are normally applied to the press rolls, pick-up roll, suction rolls and/or couch roll of the paper machine. However, double and twin doctors can be used to advantage on other rolls.

The two blades of the double doctor are carried in two independent holders which, in turn, are supported by two independent, or semi-independent, doctor beams. The twin doctor also uses two independent holders, but these holders are both carried on a common, single doctor beam.

Both the double and the twin doctor perform exactly the same function, but the double doctor includes several desirable features not available on the twin doctor. On the other hand, the twin doctor is more economical in its use of space, and its manufacturing costs are considerably less than the double doctor.

The first blade of the double and twin doctor acts in exactly the same way as a regular single bladed doctor; it is used to prevent the web from wrapping around the roll and also removes any foreign material which may cause marking of the web.

In recent years, a number of developments have taken place which have enabled paper machines to be operated at hitherto unprecedented speeds. (A typical example of this is the steam box).

One of the side effects of significantly increasing the speed of the paper machine, is that a partial vacuum is created behind the doctor blade by the action of the roll passing the blade at high speed (this is known as the "foil effect"). This foil effect is responsible for pulling furnish (pulp and fibre material) out of the pores of the roll, and this material (referred to as "crumbs") then accumulates on the rear side of the doctor blade. When these crumbs reach sufficient mass to enable them to escape the vacuum, they may be dragged around the roll until they enter the nip of the roll with the web and either cause the web to break, or result in serious machine damage.

This problem was initially countered by installing a second (single bladed) doctor on the roll to prevent the crumb material from travelling around the roll. However, in many cases there was inadequate space for a second doctor to be installed and, where space was available, the second blade then created its own foil effect and produced more crumbs.

It was then realised that the only practical way to overcome the crumbing problem would be thoroughly to wash the pores of the roll to remove all the furnish so that there would be nothing in the pores for the foil effect to extract. This required the use of a high pressure washing shower.

Since it was impractical to wash the roll surface after the (single) doctor blade (the applied water would travel with the roll and re-wet the paper web), numerous devices were developed to try to wash the roll just prior to the (single) doctor blade. The spent wash water could then be removed safely by the (single) doctor blade.

None of these attempts was very successful. The principal reason for failure was that the high water pressure required to penetrate the roll pores at high roll speeds was such that it simply rebounded from the roll and re-wet the paper web on the adjacent roll(s).

The solution to the dilemma was to use a twin (or double) bladed doctor to isolate a sector of the roll face, and to apply the high pressure washing shower between the two blades. In this way, the wash water could not escape from between the two blades and could not therefore re-wet the paper web. Further, if the roll pores were adequately washed before reaching the second blade, there would be no crumb material left in the pores for the foil effect of the second blade to extract.

From the above, it can be seen that the prime purpose of a twin or double doctor is to isolate a sector of the roll face to enable it to be thoroughly washed.

Typically, the wash shower employed requires a minimum of about 4 bar (60 psi) of water pressure applied through fan-tail jets, and at a temperature similar to that of the roll. The spent water normally falls by gravity into a vat (re-pulper) below the machine. This vat is where the web is led to be re-cycled after being doctored off the roll.

The first blade of the doctor acts as a regular doctor for removing the web when necessary and for keeping the roll face free of surface deposits. The second blade ensures that all the spent wash water is retained to prevent it from re-wetting paper web. In other words, the second blade is a water seal.

The cleaning efficiency of this washing shower situated between the two blades depends on several factors, including machine speed, the porosity and hardness of the roll, the angle of trajectory of the water, the water

pressure, the water temperature, and the nature of the contaminants (furnish) to be removed.

Further, it is extremely important to ensure that the water temperature is virtually the same as the roll face temperature. Failure to achieve this can lead to roll stress which at best results in unacceptable roll (and hence web) profiles, and at worst can cause roll failure.

The continuous supply of large quantities of hot water at high pressure is expensive, and the control of the water temperature to within a few degrees is often difficult. In addition to this, the large quantities of spent water from the shower have to be dumped into the re-pulper below the machine and this causes significant dilution of the re-cycled paper stock. For these reasons, many machine operators try to use their double or twin doctors with the wash shower turned off, or operating at reduced volume or pressure. The result is a considerable loss in doctoring efficiency which leads to other production problems.

One object of the present invention is to provide a doctor assembly with an improved roll cleaning capability.

Another object of the present invention is to provide a doctor assembly which can clean a roll surface effectively, using a reduced quantity of wash water.

According to the present invention there is provided a doctor assembly for a rotating roll comprising a first doctor blade arranged adjacent to the roll surface at a first circumferential position, a second doctor blade arranged adjacent to the roll surface at a second circumferential position after the first circumferential position in the direction of rotation of the roll, and a wash spray means directing a wash liquid on to that part of the roll surface between the first and second doctor

blades, wherein a wiping element is provided contacting the roll surface between the doctor blades.

The wiping element preferably contacts the roll at a part of the roll surface between the part wetted by the wash spray means and the second doctor blade.

Alternatively, the wiping element may contact the roll at a part of the roll surface between the part wetted by the wash spray means and the first doctor blade. As a further alternative, the wash spray means and the wiping element may be at least partly co-extensive, for example the wash spray means may be within the wiping element.

Preferably, the wiping element is a brush in frictional contact with the roll. The wiping element may alternatively be selected from a pad of felt or similar material, a mop or a flexible 'squeegee' blade or other wiping device.

The wiping element may extend the entire axial length of the roll. Alternatively, the wiping element may extend less than the entire axial length of the roll, the wiping element being mounted for axial movement relative to the roll to enable the length of the roll to be contacted. The wiping element may be rotatable, continuously or intermittently.

In an advantageous embodiment, the wiping element is a brush extending for the entire axial length of the roll, and mounted on a conventional doctor beam to oscillate in the axial direction of the roll.

The wiping element is preferably biased against the roll, so as to compensate for wear of the wiping element.

Embodiments of the invention will now be described in detail, with reference to the accompanying drawings, in which:

Figure 1 shows an axial end view of a double doctor beam and blades, with a washing spray and wiping element; and

Figure 2 shows an axial end view of a twin doctor beam and blades, with a washing spray and wiping element.

Referring now to the drawings, in which corresponding parts have like reference numbers, there is seen in Figure 1 a mounting trunnion 1 which supports a doctor beam 2 on a machine frame (not shown). The doctor beam 2 carries first and second doctor blades 3 and 4, which contact the surface of a roll 5 (rotating clockwise as seen in the figure).

First doctor blade 3 is carried on a support 6, on which is also mounted a number of pivots 7 carrying brackets 8 to support a wash spray pipe 9 and a wiping element 11. Brackets 8 are biased in a clockwise direction about pivots 7 by a pneumatic hose 10. Alternatively, resilient or other biasing means may be used to urge the brackets 8 away from the support 6 and bring the wiping element 11 into contact with the roll 5. Water from the spray pipe 9 is directed on to the roll 5, wetting the surface of the roll 5 behind the first doctor blade 3.

A wiping element such as a brush 11 is mounted on the spray pipe 9, so as to contact the surface of the roll 5 after the area wetted by the spray pipe 9 ('behind' and 'after' are here used to refer to the direction of rotation of the roll 5). The resilient or other biasing of the brackets 8 ensures that the wiping element 11 remains in contact with the roll 5 even after the wiping element is worn. The use of a pneumatic hose 10 not only allows the pressure of wiping element 11 on roll 5 to be controlled, by adjusting the pressure in hose 10, but also ensures that the pressure is even along the length of the roll 5.

Limit screws 12 are provided to prevent the spray pipe 9 from moving too close to the roll 5, the screws 12 abutting the carrier 6 to limit the travel of the spray pipe 9.

The wiping element 11 itself (i.e. the felt pad, squeegee, bristles, etc.) is intended to be sacrificial, and to be easily replaced when worn. The wiping element 11 may be of natural or synthetic materials, fibres, bristles etc.

Figure 2 shows a double doctor, the trunnion 1 supporting an end plate 2 to which a pair of beams 2a and 2b are fixed. Beam 2a carries the first doctor blade 3, spray pipe 9, and wiping element 11, while beam 2b carries the second doctor blade 4. In other respects, the arrangement is as shown in Figure 1.

Alternatively, beams 2a and 2b may be independently mounted to the machine frame. It is also foreseen that the spray pipe 9 and wiping element 11 may be mounted on the 'trailing' beam 2b, and that the spray pipe may be fixed to one of the beams 2a or 2b while the wiping element 11 is fixed to the other.

The doctor assembly of the invention enables considerably less water to be used and therefore provides both a significant cost saving and reduced dilution of the re-pulper chest contents.

The action of the wiping element on the roll provides for better roll face cleaning, by firstly distributing the cleaning water more evenly over the roll face to give more uniform cleaning, and secondly preventing pressurised water from reaching the second blade and thus make it easier for the second blade to form a good water seal. Roll face "streaking" caused by high pressure water jets cleaning non-uniformly (e.g. due to a blocked spray nozzle) would be eliminated.

The wiping element prevents most of the contaminants (crumbs) from ever reaching the second blade, thus reducing the amount of work which the second blade has to perform. Also, non-uniform roll wear resulting from non-uniform water distribution would be eliminated thus saving on the frequency of roll re-grinds.

Uniform cleanliness of the roll would reduce non-uniform wear to the roll, which in turn will reduce "felt streaking", and thereby prolong felt life resulting in significant cost savings.

CLAIMS

1. A doctor assembly for a rotating roll (5) comprises a first doctor blade (3) arranged adjacent the roll surface at a first circumferential position, a second doctor blade (4) arranged adjacent the roll surface at a second circumferential position after the first circumferential position in the direction of rotation of the roll (5), and a wash spray means (9) directing a wash liquid on to that part of the roll surface between the first and second doctor blades, characterised in that a wiping element (11) is provided contacting the roll surface between the doctor blades (3, 4).
2. A doctor assembly as claimed in claim 1, characterised in that the wiping element (11) contacts the roll (5) at a part of the roll surface between the part wetted by the wash spray means (9) and the second doctor blade (4).
3. A doctor assembly as claimed in claim 1, characterised in that the wiping element (11) contacts the roll (5) at a part of the roll surface between the part wetted by the wash spray means (9) and the first doctor blade (3).
4. A doctor assembly as claimed in claim 1, characterised in that the wash spray means (9) and the wiping element (11) are at least partly co-extensive.
5. A doctor assembly as claimed in claim 4, characterised in that the wash spray means (9) is within the wiping element (11).
6. A doctor assembly as claimed in any preceding claim, characterised in that the wiping element (11) comprises a brush in frictional contact with the roll.

7. A doctor assembly as claimed in any one of claims 1 to 5, characterised in that the wiping element (11) is selected from a pad of felt or similar material, a mop, and a flexible 'squeegee' blade.

8. A doctor assembly as claimed in any preceding claim, characterised in that the wiping element (11) extends the entire axial length of the roll (5).

9. A doctor assembly as claimed in any one of claims 1 to 7, characterised in that the wiping element (11) extends less than the entire axial length of the roll (5) and is mounted for axial movement relative to the roll to enable the entire length of the roll to be contacted.

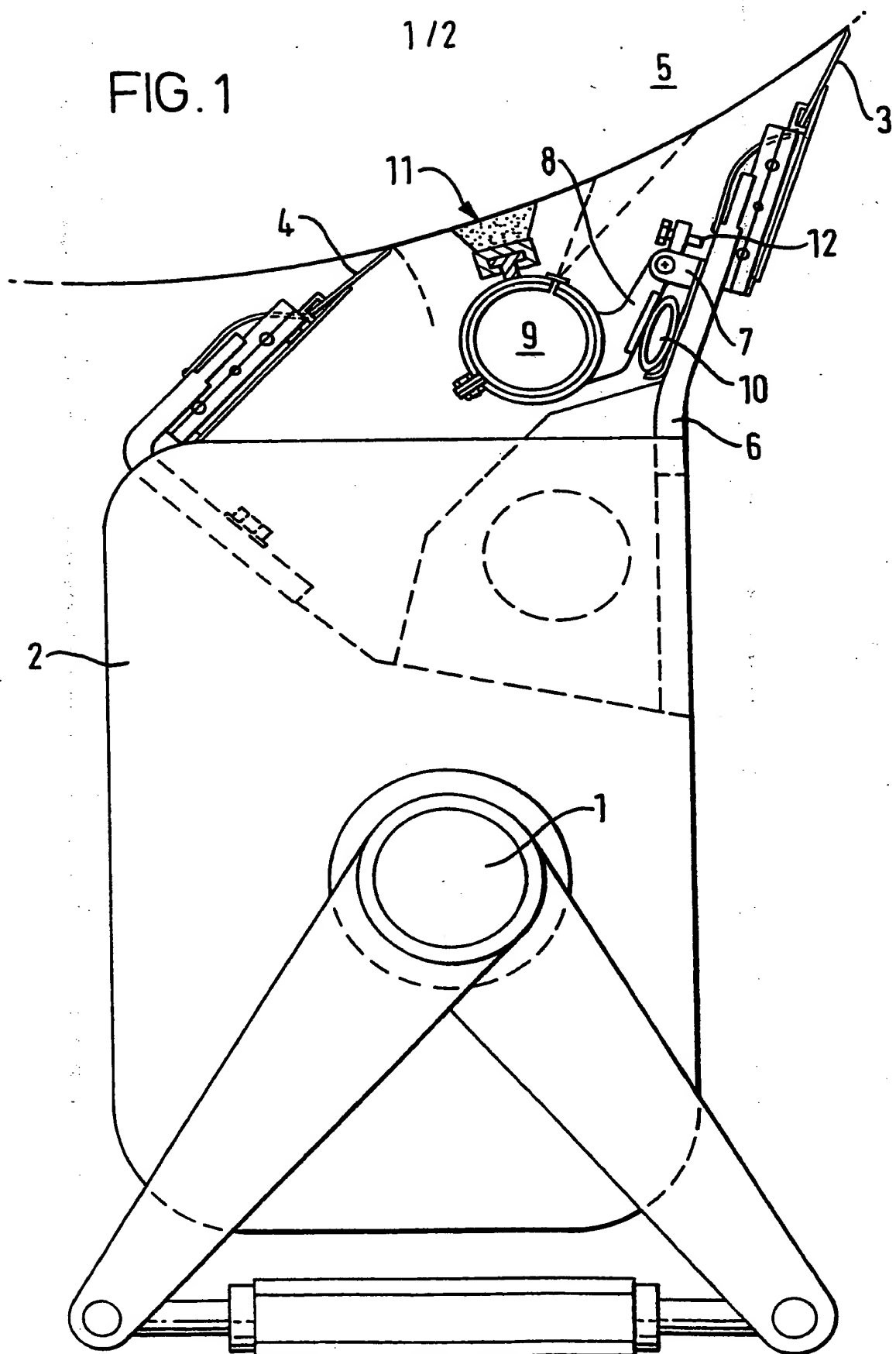
10. A doctor assembly as claimed in any preceding claim, characterised in that the wiping element (11) is rotatable.

11. A doctor assembly as claimed in claim 10, characterised in that the wiping element (11) is continuously rotatable.

12. A doctor assembly as claimed in claim 10, characterised in that the wiping element (11) is rotatable intermittently.

13. A doctor assembly as claimed in any preceding claim, characterised in that means is provided for biasing the wiping element (11) against the roll (5).

FIG. 1



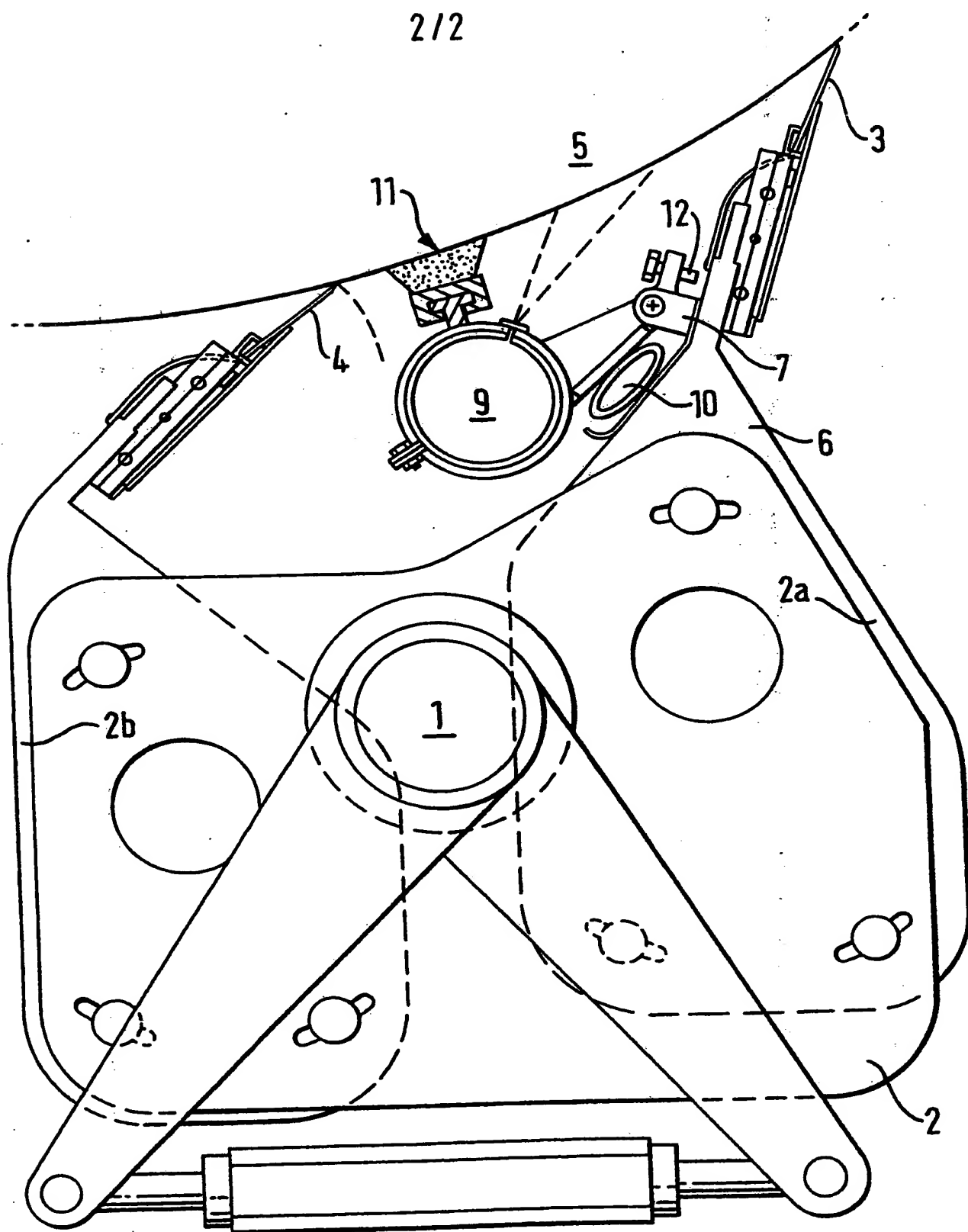


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/03442

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 D21G3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D21G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 91 18146 A (VICKERYS LTD ; LEIGHTON ROBERT (GB)) 28 November 1991 see figure 2 see page 7, line 14 - line 22 see page 17, line 17 - page 19, line 5 see whole document	1,6-13
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Y	US 4 265 705 A (PYYKKOENEN MARKKU) 5 May 1981 see column 4, line 10 - line 52 see figure 2 see whole document	1,6-13
A		2-5

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/03442

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 021 124 A (TURTINEN PEKKA ET AL) 4 June 1991 see figure 3B	1,6-13
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Appl. Application No

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